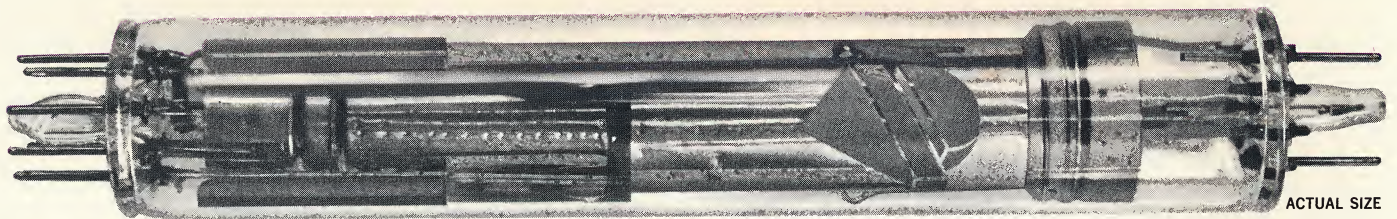


**16 Breakthroughs  
you can make  
with the Lithocon.<sup>T.M.</sup>**

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# Forget everything you ever knew about storage tubes.



ACTUAL SIZE

## **This is the amazing new Lithocon...**

a unique combination of the most advanced semiconductor and electron tube technology.

Essentially, it's a remarkably improved and miniaturized high performance storage tube, made possible by the unique characteristics of the exclusive Princeton Electronic Products silicon storage target.

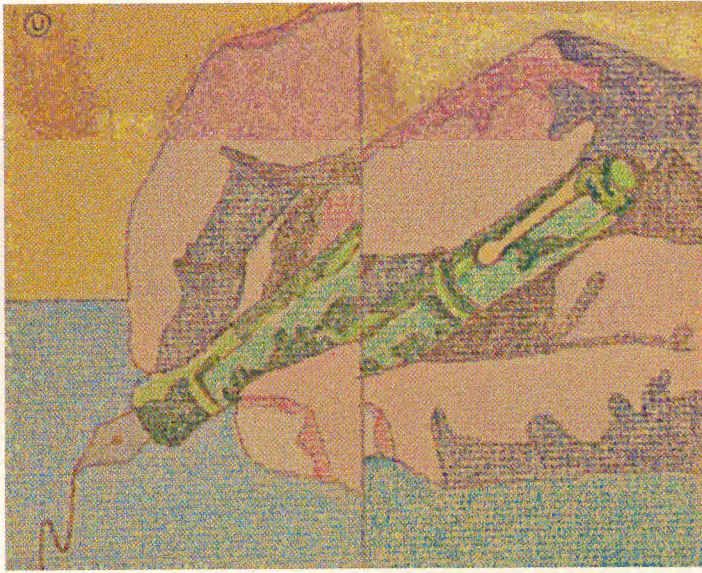
Remember how big the old storage tubes were? The Lithocon is just seven inches long, one inch in diameter. Remember how efficiently the old storage tubes didn't work? The Lithocon has a 30-minute memory, high resolution, full gray scale, high-speed write and selective erase. Remember how expensive the old ones were? The Lithocon costs only a small fraction of that price.

The Lithocon's applications and possibilities are so numerous that we ourselves have only scratched the surface. Its size and capabilities will revolutionize the design and performance of countless systems in nearly every industry.

The remaining part of this booklet will describe 16 breakthroughs made possible by the Lithocon.

Study them carefully, and the 17th may be yours.





# Computer Breakthroughs:

## Interactive graphic displays.

In contrast to other image storage displays, the Lithocon separates display and storage functions. You get a higher quality display in addition to a lot more operator interaction; net result—interactive graphics at the lowest cost ever.

## Alphanumeric terminals.

The Lithocon provides an inexpensive way to use conventional television receivers for information display. This will result in maximum reliability and low field maintenance costs.

## Projection displays.

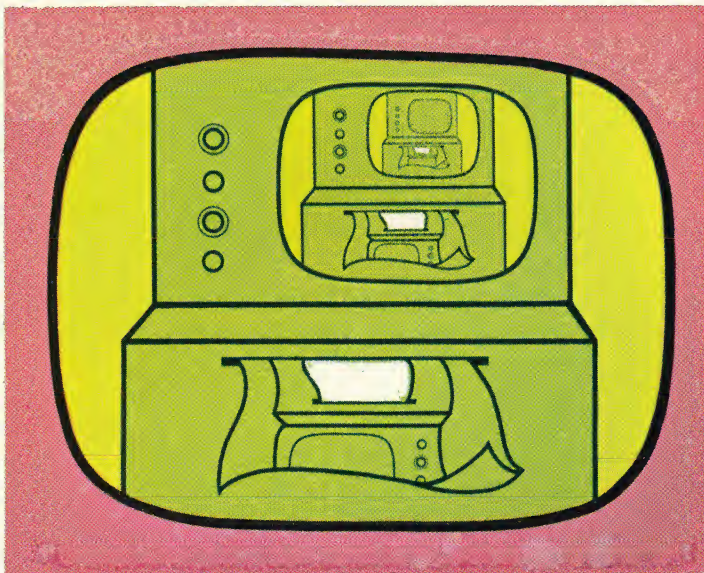
The Lithocon's versatility makes it compatible with a wide variety of projection displays. High brightness projection cathode ray tubes and laser displays are two good examples.

## Hybrid display systems.

The wide dynamic range and image stability of the Lithocon allow for unique superposition of Alphanumeric-graphics information on full-range video images.

The Lithocon's high speed selective erase, fast write and exceptional retention and stability will lead to dramatic advances in computer displays . . . with equally dramatic decreases in cost.





# Information Storage & Retrieval

## Facsimile.

Remember, the Lithocon is only seven inches long and one inch in diameter. That makes it just the device you need in the manufacture of fully portable soft-copy facsimile units for use by doctors, field engineers, law enforcement officers, and now, maybe even someone in your business.

## Microfiche microfilm.

The Lithocon's high speed, high resolution and long retention capability mean that remote time-shared information retrieval systems can finally be utilized to their fullest extent at substantial reductions in cost.

## Education consoles.

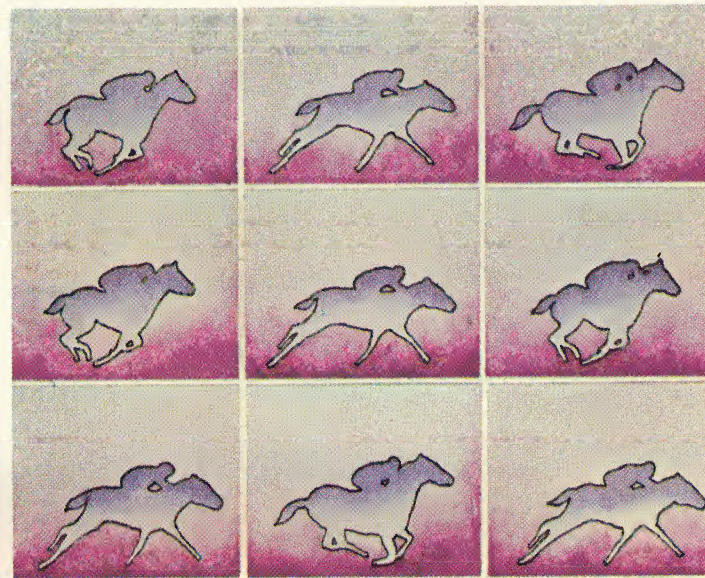
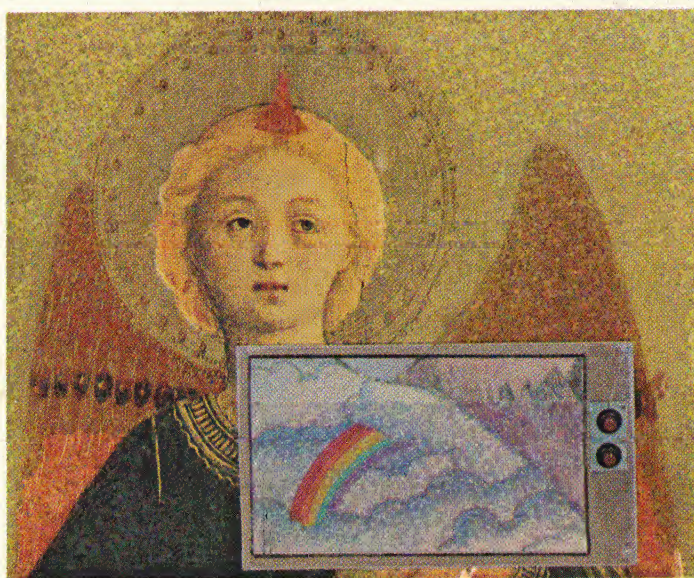
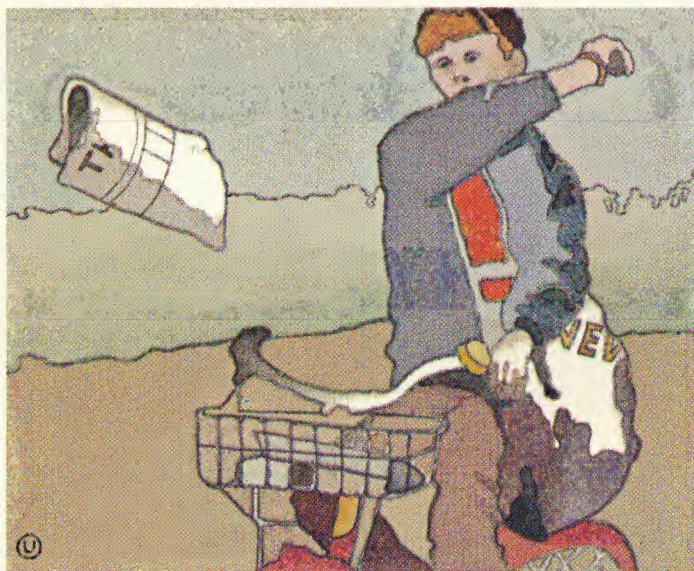
Thanks to the Lithocon, an inexpensive, highly versatile display terminal is now possible at a cost low enough for almost any educational system.

## Air traffic control consoles.

Hooked up to a computer, the Lithocon can give you high quality background information, such as weather maps, alphanumeric and general graphics.

Exciting new systems concepts have been opened up by the Lithocon's ability to store full-range video information for extended periods.





# eval System Breakthroughs:

## Photo— composition.

For magazines, newspapers and other publishing projects, the Lithocon allows for low cost on-line editing and verification systems.

## Industrial control.

Electronic industrial inspection and supervision will both be simplified by the Lithocon's single-frame storage electronic enlargement capabilities.

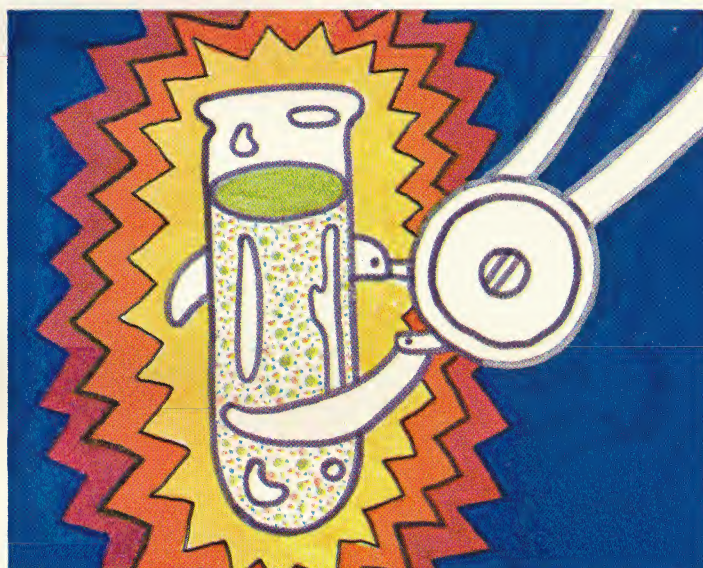
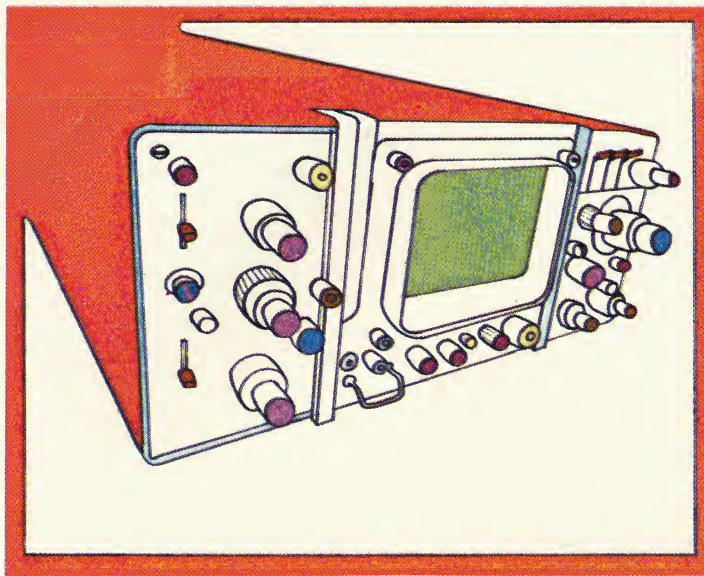
## X-Ray fluoroscope.

With the Lithocon, you can build a simple system that will framesnatch x-ray images from your present x-ray system for later detailed study.

## Commercial TV System.

With the Lithocon, you no longer need high-priced video-tape recorders to do your single-frame snatching, generator locking and PAL, secan and NTSC signal conversions.





# Display Breakthroughs:

## High-speed storage oscilloscopes

The Lithocon is uniquely suited for the capture of high-speed, nonrepetitive events. It will give dramatic improvement in the viewed image through the use of signal processing and enhancing circuitry and the separation of the display and storage functions.

## Scan converters.

The Lithocon's high writing speed and fast erase make it suitable for time-shared signal format conversion with a minimum of peripheral circuitry.

## Patient monitoring systems.

The Lithocon can store data from multiple sensors and then display it on one or more remote television monitors, providing an inexpensive and practical method for consultation by several doctors at remote locations.

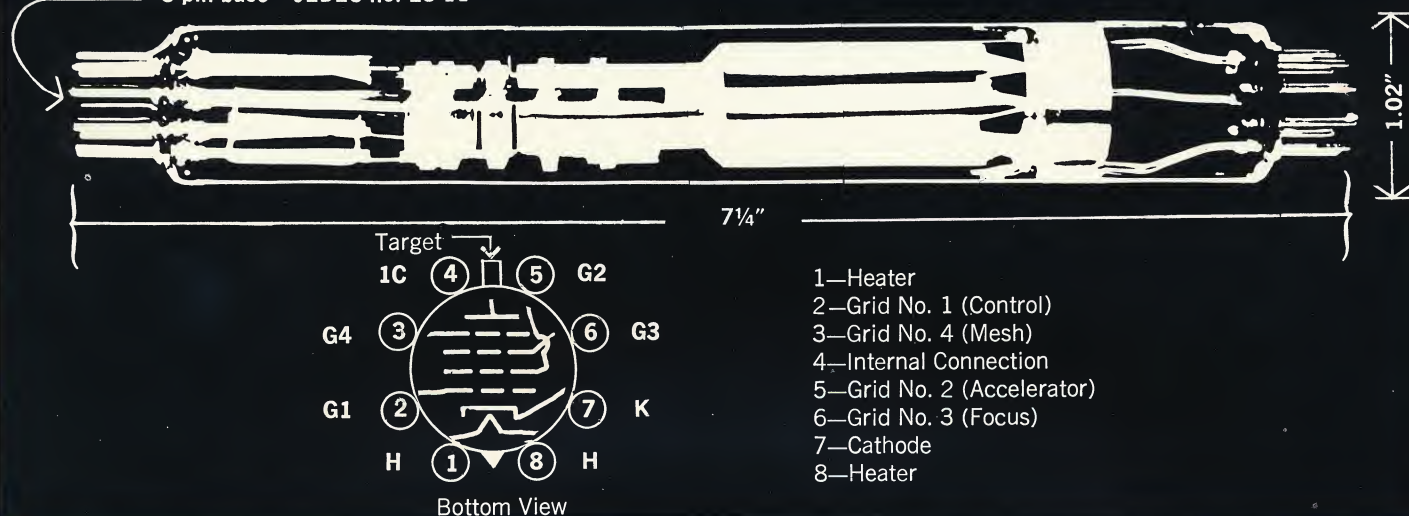
## Signal analyzers.

The Lithocon's extraordinarily high packing density has the storage capacity necessary for correlation of the numerous single event input signals required in such areas as nuclear instrumentation.

The high writing speed, high resolution and long retention time are uniquely suited to the development of high performance signal storage and processing systems.



8-pin base JEDEC no. E8-11



- 1—Heater
- 2—Grid No. 1 (Control)
- 3—Grid No. 4 (Mesh)
- 4—Internal Connection
- 5—Grid No. 2 (Accelerator)
- 6—Grid No. 3 (Focus)
- 7—Cathode
- 8—Heater

Bottom View

## General description.

The Lithocon series of low cost storage tubes are designed with a range of parameters to suit individual specifications. For information concerning specific types contact the company directly.

Limiting Resolutions ..... 700-1200 TV lines  
Retention Times<sup>a</sup> ..... 10-60 minutes  
Writing Speeds<sup>b</sup> ..... 20-120 ns/spot  
Selective Erase Speeds<sup>c</sup> ..... 100- 600 ns/spot  
Gray Scale<sup>d</sup> ..... 5 Logarithmic levels  
Signal Current ..... 400 nA typical

## General data.

### Heater:

Voltage (AC or DC) ..... 6.3 ± 10% volts  
Current (at 6.3 volts) ..... 300, 600 mA

### Direct Interelectrode Capacitance:

Target to all other electrodes ..... 5 pF  
Focusing Method ..... Magnetic<sup>e</sup>  
Deflection Method ..... Magnetic<sup>e</sup>  
Operating Position ..... Any  
Scanned Area ..... 0.5" x 0.5" max.  
Coil Assembly ..... Celco Model BV-232 or equivalent

## Typical operating conditions.

	Read	Write	Erase
Target .....	5	60-300	15 Volts
Grid No. 4 .....	450	450	450 Volts
Grid No. 3 .....	230	230 <sup>f</sup>	230 <sup>f</sup> Volts
Grid No. 2 .....	300	300	300 Volts
Grid No. 1 .....	-30	g	0 to -30 Volts
Maximum Field Strength at center of focus coil ...	50	50	50 Gauss
Peak Deflecting-Coil Current:			
Horizontal .....	600	600	600 mA
Vertical .....	600	600	600 mA

## Typical operation.

**Write cycle...** To write, the target (signal electrode) is placed at approximately +250v and Grid #1 is placed at approximately -40v. For Z-axis modulation the information to be stored is applied to Grid #1 with a peak-to-peak signal of approximately 20v. These conditions allow the information to be written within one TV frame time (1/30 sec). Other writing modes include x-y deflection and target voltage modulation.

### Nondestructive read cycle...

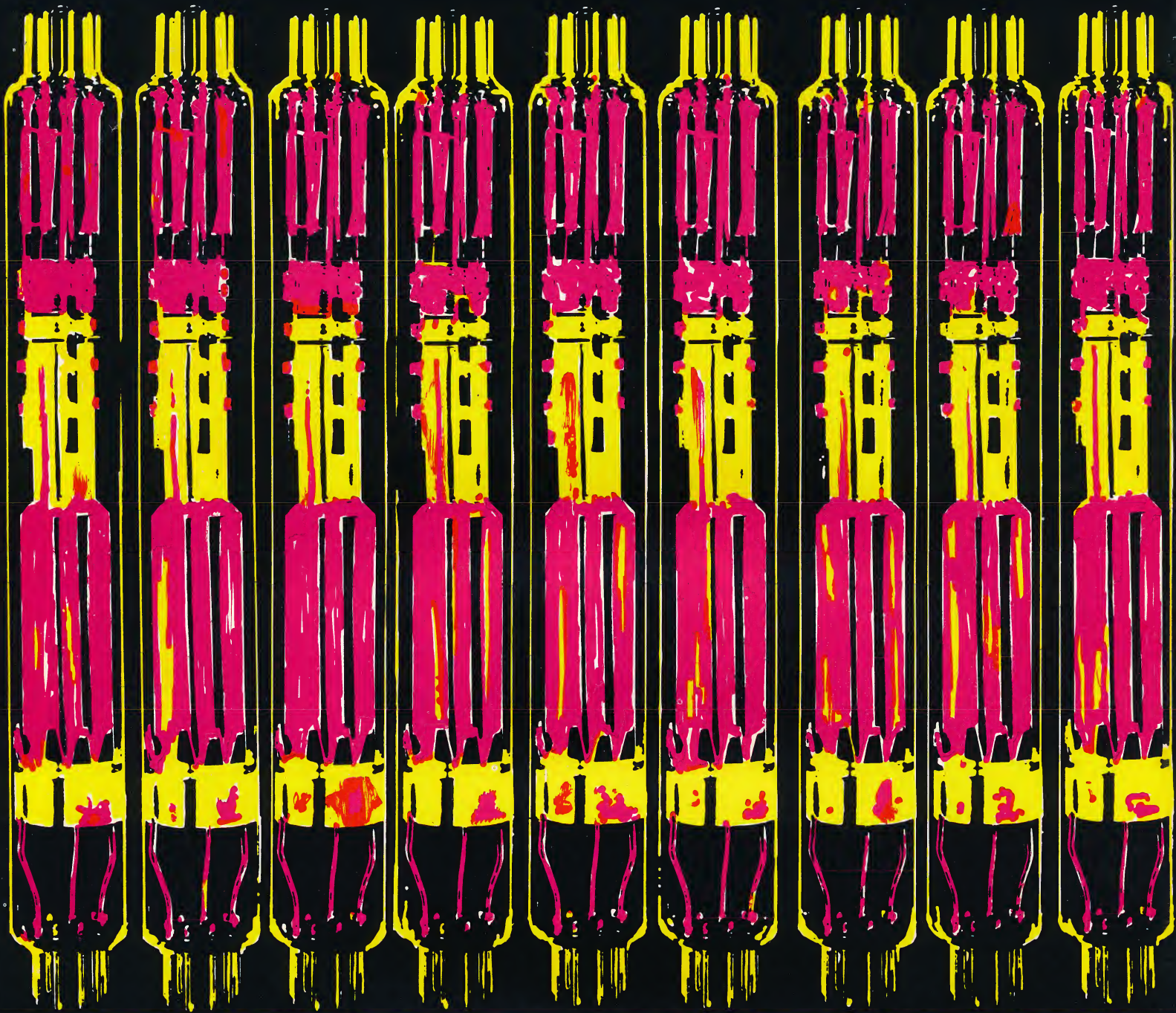
Immediately after the write cycle, the target is returned to about +8v for readout. The target is scanned in conventional raster format with the grid voltage adjusted to yield a peak-peak output signal of approximately 200nA. Retention time can be significantly extended with reduced readout current. With the beam cut-off the information can be stored for at least one week.

**Erase cycle...** Selective erase of a signal stored on the target may be accomplished by applying +20 volts to the target and scanning the area to be erased. After erase, that portion of the target is now ready to accept new information without the need for a "prime" cycle. Complete erase is achieved by scanning the full target.

- a. Defined as 50% reduction in maximum signal current
- b. Defined to yield output signal change > 50nA
- c. Defined to reduce signal to < 5% of maximum value
- d. Defined as log<sub>2</sub> (Maximum Signal Current/Noise Level)
- e. Electrostatic focus and deflection types are currently under development
- f. These values are approximate and depend upon Write voltage on target. Correction is needed to yield optimum focus during these operations
- g. This value can vary significantly depending on scanning speed. For TV frame snatching, a value of -40 volts is typical.

For further information contact Mr. Wilburt M. Herbener, Vice President, Marketing, Princeton Electronic Products, P.O. Box #87, Princeton Junction, New Jersey 08550, Telephone: (609) 921-2088.



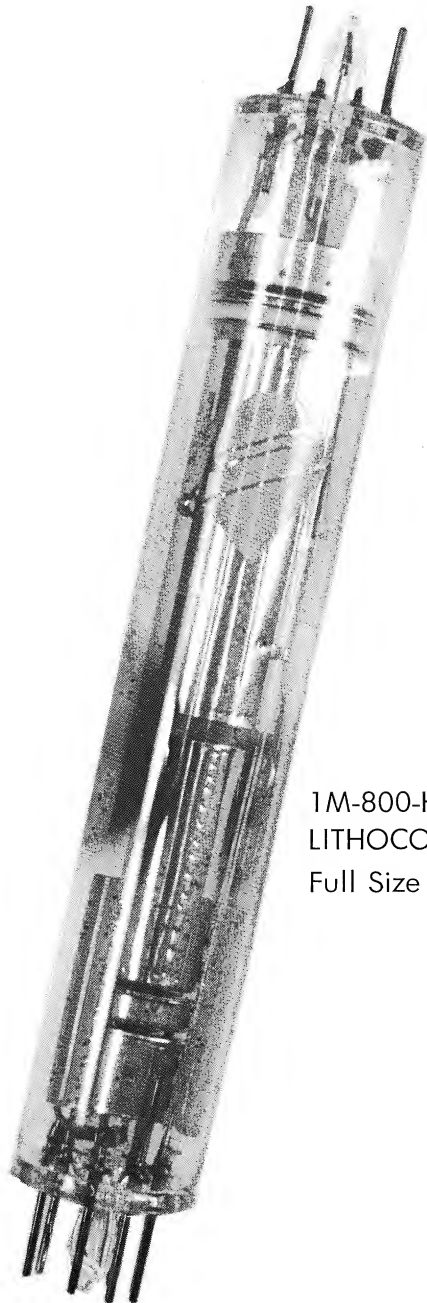


PRINCETON ELECTRONIC PRODUCTS, INC. P.O. BOX 87 PRINCETON JUNCTION, N.J. 08550 • 609/921-2088



# LITHOCON<sup>TM</sup>

1M-800-HS  
Electrical  
Storage Tube



1M-800-HS  
LITHOCON  
Full Size

## GENERAL DESCRIPTION

The LITHOCON series of miniaturized storage tubes employs a silicon storage target which is addressed by a focused electron beam. Bias conditions are similar to those used with a standard 1" vidicon camera tube employing magnetic deflection and focus.

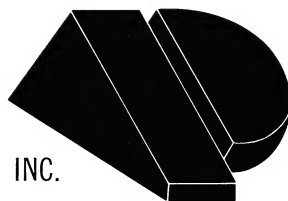
The LITHOCON features:

- High writing speed
- Fast selective erase
- Full gray scale
- Data rate input from DC to MHz
- Limiting resolution of 800 TV lines
- Extended read-out with full gray scale
- Storage time  $> 1$  week with beam cut-off
- Low voltage operation

## APPLICATIONS

Alphanumeric Computer Consoles  
Interactive Graphic Displays  
Educational TV Consoles  
Information Storage & Retrieval Systems  
Airborne Instrumentation  
High-Speed Storage Oscilloscopes  
Facsimile Systems  
Analog Signal Processing

PRINCETON ELECTRONIC PRODUCTS, INC.



P. O. BOX 87, PRINCETON JUNCTION, N. J. 08550



# ELECTRICAL DATA

## General:

### Heater:

Voltage (AC or DC) .....	6.3 $\pm$ 10% volts
Current (at 6.3 volts) .....	300 mA

### Direct Interelectrode Capacitance:

Target to all other electrodes .....	4.5 pF
Grid No. 1 to all other electrodes .....	3.0 pF

Focusing Method ..... Magnetic

Deflection Method ..... Magnetic

Operating Position ..... Any

Maximum Scanned Area ..... 0.5" x 0.5"

Coil Assembly<sup>a</sup> ..... Celco Model BV-232-S650/650-F300-A283 or equivalent

## Maximum Ratings:

Target Electrode .....	400 volts
Grid No. 4 (Mesh) .....	1000 volts
Grid No. 3 (Focus) .....	1000 volts
Grid No. 2 (Accelerator) .....	600 volts
Grid No. 1:	
Negative Bias .....	300 volts
Positive Bias .....	0 volts

### Heater-Cathode Voltage:

Heater negative with respect to cathode .....	125 volts
Heater positive with respect to cathode .....	10 volts

## Typical Operating Conditions:

	<u>Read</u>	<u>Write</u>	<u>Erase</u>	
Target Electrode .....	5	60-300	15	volts
Grid No. 4 (Mesh) .....	450	450	450	volts
Grid No. 3 (Focus) .....	230	b	b	volts
Grid No. 2 (Accelerator) .....	300	300	300	volts
Grid No. 1 (Signal) .....	-30	c	-30 to 0	volts
Field Strength at center of focus coil .....	50	50	50	gauss
Peak Deflecting Coil Current:				
Horizontal .....	600	600	600	mA
Vertical .....	600	600	600	mA
Cathode Blanking Potential .....	70	70	70	volts



# PERFORMANCE

Limiting Resolution (see Fig. 1) .....	800 TV lines
Writing Speed <sup>d</sup> (see Fig. 2) .....	4 $\mu$ sec/scan
Selective Erasing Speed <sup>e</sup> .....	300 $\mu$ sec/scan
Retention Time <sup>f</sup> .....	12 minutes
Logarithmic Gray Levels <sup>g</sup> .....	5 minimum
Signal Output Current .....	400 nA typical

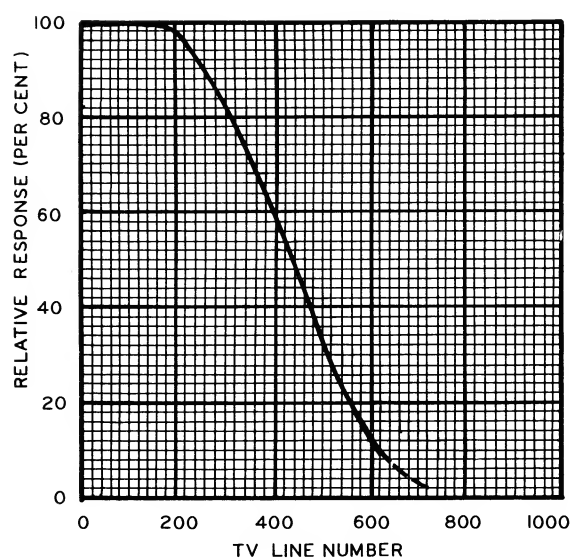


Figure 1—Relative response measured by the orthogonal Read-Write technique. Resolution curve represents the overall Read-Write response for a scanned area of 0.5" x 0.5".

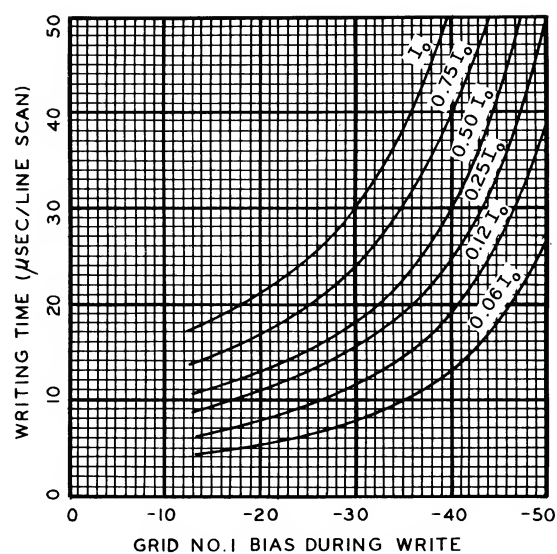


Figure 2—Writing time curves with target set at 250 volts during Write Cycle.  $I_0$  is the maximum signal output current during Read. Reduced target voltage during Write Cycle will increase writing time.

- Constantine Engineering Laboratories Company, Mahwah, New Jersey.
- Correction of up to  $\pm 5\%$  in Grid No. 3 voltage is needed to maintain optimum focus during these operations. Deflection sensitivity will vary slightly with target voltage unless Grid No. 3 potential is accurately adjusted.
- During x-y writing mode this value can vary significantly depending upon scanning speed (see Figure 2). For TV frame snatching, a value of -50 volts is typical.
- Maximum value which yields output signal current  $> 100\text{nA}$  with Grid No. 1 voltage set to zero during Read.
- Residual Signal  $< 5\%$ .
- Time required for the "black level" to reach 50% of maximum signal level.
- Defined as  $\log_2$  (Maximum Signal Current/Average Signal Fluctuation).

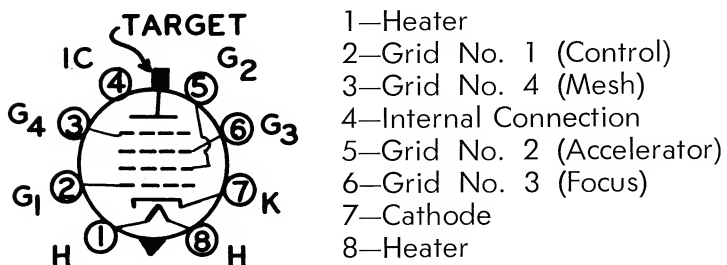


# OPERATING CONDITIONS

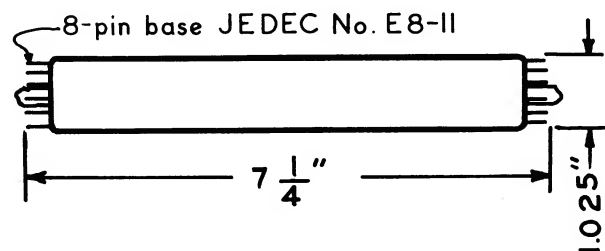
**WRITE CYCLE** . . To write, the target (signal electrode) is placed at approximately +250v and Grid #1 is placed at approximately -50v. For Z-axis modulation the information to be stored is applied to Grid #1 with a peak-to-peak signal of approximately 20v. These conditions allow the information to be written within one TV frame time (1/30 sec). Other writing modes include x-y deflection and target voltage modulation.

**NONDESTRUCTIVE READ CYCLE** . . Immediately after the write cycle, the target is returned to about +5v for readout. The target is scanned in conventional raster format with the grid voltage adjusted to yield a peak-peak output signal of approximately 400nA. With the beam cut-off the information can be stored for at least one week.

**ERASE CYCLE** . . Selective erase of a signal stored on the target may be accomplished by applying +15 volts to the target and scanning the area to be erased. After erase, that portion of the target is now ready to accept new information without the need for a "prime" cycle. Complete erase is achieved by scanning the full target.



Bottom View



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